

SNOW SAMPLING SURVEY
IN THE VICINITY OF
BOISE CASCADE CANADA LTD.
KENORA, FEBRUARY 1988

MAY 1989



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Minister

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KENORA, FEBRUARY 1988

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INTRODUCTION

Boise Cascade Canada Ltd. operates an integrated groundwood, sulphite pulp and newsprint mill in the Town of Kenora. A snow sampling survey in 1977 revealed that the mill was a source of emissions of sulphate and carbon¹. A follow-up survey in 1982 indicated an overall decrease in contaminant deposition and very little fallout off company property². To document the current situation, another snow sampling survey was conducted in 1988.

METHODS

Single samples of snow were collected on February 3, 1988 from 13 sites near the Boise Cascade mill (Figure 1) and from two control sites remote from the study area. Core samples of the complete snow profile were obtained following standard Ministry sampling procedures³. Snow meltwater samples were submitted to the Ministry's Thunder Bay and Toronto laboratories for determination of carbon (dissolved organic carbon, dissolved inorganic carbon, and total particulate carbon), solids (suspended solids, dissolved solids, and total solids), sodium, sulphate, conductivity and pH.

RESULTS AND DISCUSSION

Results from the 1982 and 1988 surveys are summarized in Table 1. In 1988, concentrations of particulate carbon were elevated near Boise Cascade compared to controls, but were lower than the levels found in 1982. At sampling sites off mill property, the contaminant guideline for particulate carbon was slightly to moderately exceeded at only three locations north of the mill. Fine black particulate matter was seen in the snow and snow meltwater from these sites. Total solids were above the guideline at five off-property sampling points, four of which were north of the pulp mill.

Sodium and sulphate levels decreased significantly from 1982 to 1988. In 1986, a scrubber was installed in the digester emission stack. This abatement action probably resulted in reduced discharge of particulate matter. Off company property, there was only one slight exceedence of the sodium guideline, and the sulphate guideline was not exceeded in 1988. The conductivity guideline was also not exceeded off mill property in 1988.

The deposition rates of particulate carbon and suspended solids were calculated. According to data from the Kenora weather office, snow was on the ground for 72 days prior to the date of the 1988 snow sampling survey, and for 98 days prior to the 1982 date. Deposition rates of particulate carbon and suspended solids are summarized in Table 2. These data show that fallout levels were quite low and well below the maximum acceptable limit of $7 \text{ g/m}^2/30$ days allowed in Ontario. Figure 2 illustrates the decline in deposition rates of suspended solids from 1982 to 1988.

Correlation matrices for the 1988 data are presented in Table 3. Except for sodium, strong positive relationships exist between all of the parameters. These relationships suggest that the contaminants originated from a common source. The strong negative relationship between these parameters and distance from Boise Cascade implicates the mill as the emission source.

CONCLUSIONS

A snow sampling survey was carried out near the Boise Cascade Canada Ltd. mill in Kenora in February, 1988. Results indicate a moderate decrease in contaminant fallout from 1982 levels. There were only a few slight to moderate exceedences of provincial contaminant guidelines at sampling points off company property. However, deposition rates of particulate matter were consistently low at all sites and did not exceed provincial objectives.

REFERENCES

1. Ontario Ministry of the Environment, 1978. Air quality, Kenora, Annual Report, 1977.
2. Ontario Ministry of the Environment, 1983. Air quality, northwestern Ontario. Annual report, 1982.
3. Ontario Ministry of the Environment, 1983. Field investigation procedures manual, Phytotoxicology Section, Air Resources Branch.

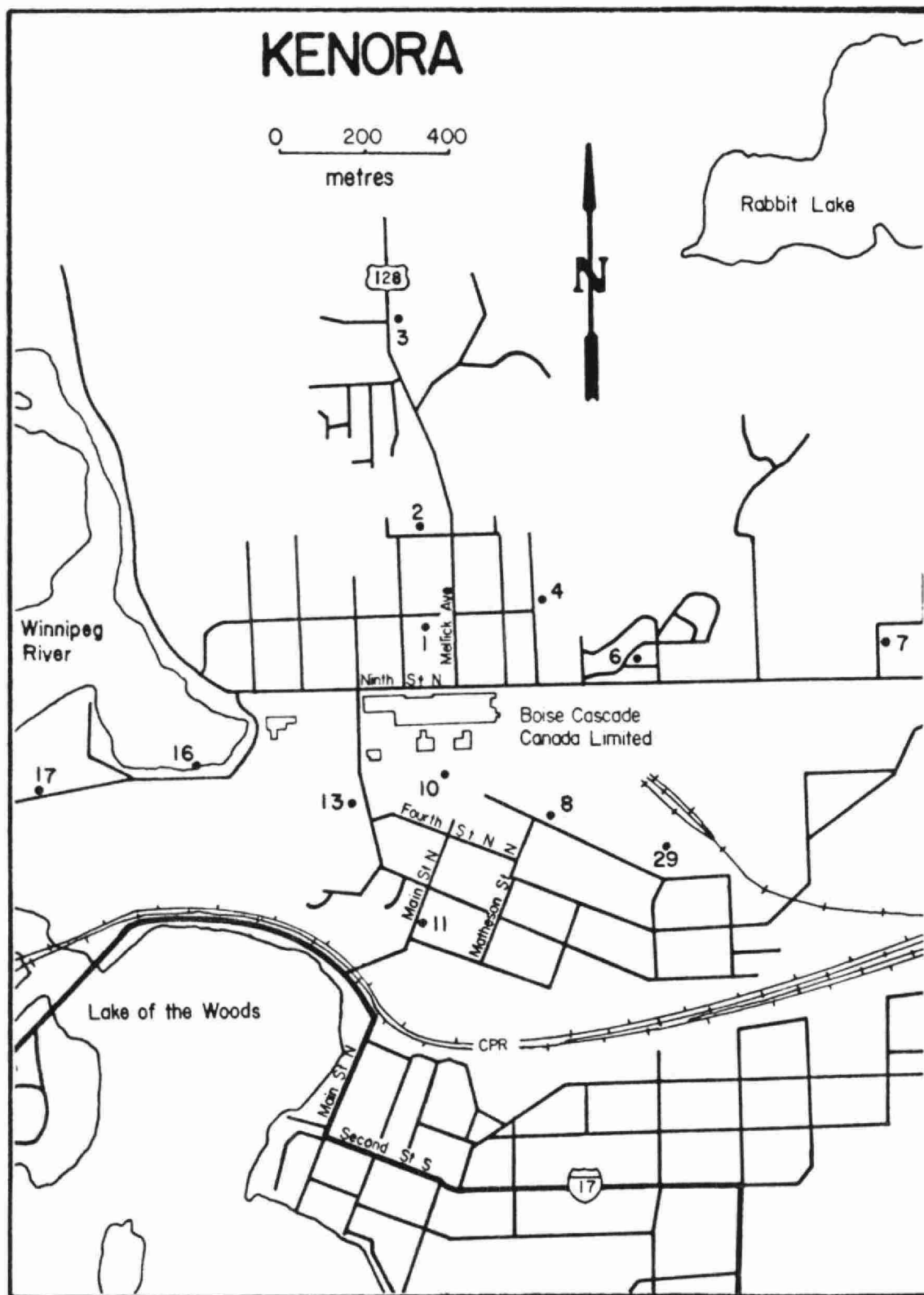


Figure 1. Snow sampling sites, Kenora, 1988.

TABLE 1. Levels of selected parameters in meltwater from snow collected near Boise Cascade Canada Limited, Kenora, in 1982 and 1988. All values are in mg/l, except conductivity (μ mhos/cm) and pH.

Site	Sodium		Sulphate		Total particulate carbon		Total solids	Conductivity		pH	
	1982	1988	1982	1988	1982	1988	1988	1982	1988	1982	1988
1	1.8	0.7	<u>6.2</u>	2.6	<u>14.0</u>	<u>12.4</u>	<u>85</u>	37	32	7.8	9.0
2	<u>5.0</u>	0.4	<u>9.5</u>	2.6	<u>25.5</u>	4.2	<u>55</u>	<u>65</u>	29	8.4	9.1
3	1.8	<u>2.3</u>	2.4	1.0	5.8	6.2	<u>55</u>	24	27	7.0	7.2
4	1.4	0.3	<u>4.4</u>	1.5	<u>7.2</u>	<u>8.4</u>	35	26	21	7.5	8.1
6	0.7	0.3	2.4	1.1	4.7	<u>14.0</u>	<u>65</u>	16	14	7.0	6.3
7	1.6	0.7	3.0	0.9	5.3	3.5	40	23	14	6.6	6.3
8 ^a	<u>5.1</u>	0.6	<u>15.5</u>	1.4	<u>30.0</u>	5.3	25	<u>84</u>	18	9.2	6.7
10 ^a	<u>10.0</u>	0.8	<u>15.5</u>	<u>5.8</u>	<u>47.5</u>	<u>25.1</u>	<u>200</u>	<u>108</u>	<u>51</u>	8.5	9.3
11	1.4	0.9	<u>3.5</u>	1.3	6.0	4.0	<u>55</u>	26	19	6.6	6.8
13	<u>2.9</u>	0.6	<u>4.4</u>	1.8	<u>15.5</u>	4.7	30	37	19	7.6	6.9
16	0.4	0.5	1.0	0.6	6.8	1.6	15	12	10	5.2	5.9
17	0.4	0.2	1.0	0.5	4.8	2.5	15	11	8	5.0	5.5
29		0.3		1.3		6.3	35		17		6.8
Controls	<0.2	<0.2	<1.0	0.6	2.8	1.6	20	12	10	4.4	4.9
Contaminant guidelines	2.0		3.0		7.0		40	45			

^aSites on company property.

^bValues exceeding contaminant guidelines are underlined.

TABLE 2. Deposition rates of carbon and solids (g/m²/30 days) in snow collected in the vicinity of Boise Cascade Canada Ltd., Kenora, in 1982 and 1988.

Site ^a	Total particulate carbon		Suspended solids	
	1982	1988	1982	1988
1	0.1	0.2	0.5	0.5
2	0.4	<0.1	1.2	0.2
3	0.1	0.1	0.5	0.5
4	0.1	0.1	0.4	0.4
6	0.1	0.2	0.2	0.7
7	0.1	<0.1	0.5	0.4
8 ^b	0.2	<0.1	0.4	0.3
10 ^b	0.4	0.3	1.1	0.6
11	0.1	<0.1	0.7	0.3
13	0.1	<0.1	0.5	0.3
16	0.1	<0.1	0.4	0.2
17	0.1	<0.1	0.2	0.2
29	-	0.1	-	0.4
Controls	<0.1	<0.1	0.2	0.2

^aSee Figure 1.

^bSites on company property.

TABLE 3. Correlation matrix of selected parameters in snow meltwater, Kenora, February 1988.

	Sodium	Sulphate	Total particulate carbon	Suspended solids	Total solids	Conductivity	pH
Sulphate	0.04						
Total particulate carbon	0.05	0.84*					
Suspended solids	0.08	0.58*	0.85*				
Total solids	0.20	0.93*	0.92*	0.73*			
Conductivity	0.33	0.94*	0.79*	0.57*	0.90*		
pH	0.12	0.80*	0.60*	0.42	0.68*	0.89*	
Dist. ^a	0.25	-0.71*	-0.61*	-0.52	-0.56*	-0.61*	-0.68*

* Denotes a significant Pearson correlation for pairs of parameters at the 95% confidence interval.

^a Distance of sample sites from Boise Cascade Canada Limited mill.

